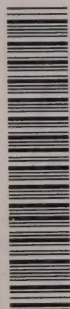


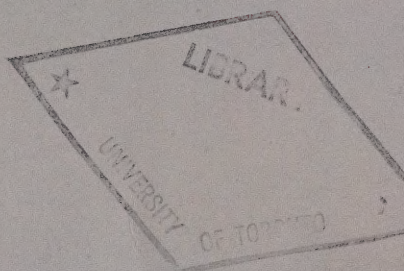
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# Hydro and the environment



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# Hydro and the environment

Every power station has some effect on the environment. So do transmission lines, whether they are overhead or underground. The main task is to ensure that the advantages for the majority of people clearly outweigh the disadvantages.

In recognition of its widespread presence in Ontario, Ontario Hydro is carrying out several major environmental programs. Among the objectives are protection of the environment, the minimizing of unsightly intrusions into the landscape and public participation in planning new facilities.

This booklet describes how Hydro is rising to these challenges in the fields of air and water quality, nuclear safety and in planning lines and stations while fulfilling its responsibility to meet demands for electric power. The cost of these programs, which is ultimately to be reflected in Hydro rates, runs into many millions of dollars.

Looking to the future, electricity is expected to play an important environmental role in providing power for rapid transit, recycling, waste treatment and other clean-up programs.

This role is foreseen in Task Force Hydro's report on nuclear power in Ontario, which strongly endorses the Canadian reactor program. Says the report: "Electricity will probably become the major energy source involved in improving environmental quality."

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# People

Environmental problems cut across every sphere of activity within Hydro. For this reason an organizational framework designed to take advantage of the knowledge of specialists in various fields has been set up to co-ordinate activities.

Three environmental committees report directly to the vice-president – engineering and operations. Two of the committees are composed of specialists in air and water quality. They include experts in meteorology, fuel supply, nuclear safety, air pollution abatement, engineering, chemistry, hydraulic studies and biology.

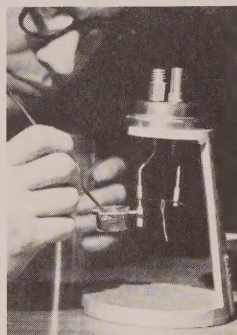
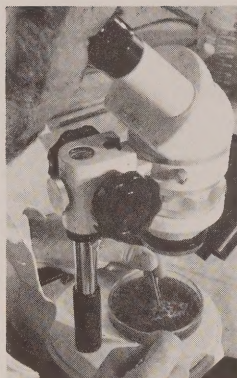
The third committee, headed by the general manager – design and construction, is composed of the directors of nine divisions. This committee deals mainly with the visual aspects of Hydro lines and stations.

Within this framework, many other specialists are on call to make their contributions. Other personnel have been assigned to project teams formed to enlist public participation in planning transmission line routes and siting generating stations.

As environmental programs have expanded, outside consultants have been engaged to carry out specific studies, including staff members of several universities.

Hydro is also co-operating with other utility systems to solve many common problems. Research costs are shared this way and everyone benefits from the pooled effort.

As well, Hydro has a number of engineers who act in an advisory capacity to consumers in fostering the wise and efficient use of electric energy for lighting, heating, air conditioning and industrial processes along with adequate insulation.



# Air

Air pollution problems should be considered in the light of Ontario Hydro's mix of generation from hydro-electric, fossil-fuelled and nuclear stations.

Nuclear stations operate continuously to supply base load while fossil-fuelled stations are often used for meeting peak demands. The effect is to conserve fossil fuels and to reduce air pollution, particularly in the Toronto area. Pickering generating station, for example, produced about 12 billion kilowatt-hours in 1975, saving the equivalent of about 4 million tons of imported coal.

More than half of Hydro's power now comes from hydro-electric and nuclear sources. In future, the nuclear proportion will increase while fossil-fuelled output will remain a relatively stable part of the generation mix.

## Hydro's program

Hydro has spent almost \$100 million for air quality control at fossil-fuelled plants over the past 25 years and much more has been committed.

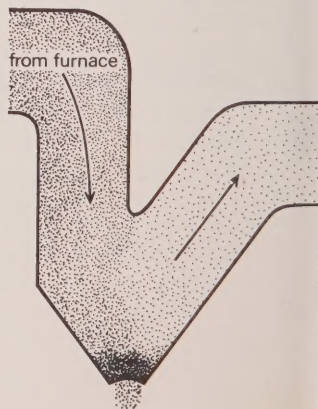
The program includes air quality control measures taken at all stations and a research program into techniques of cleansing flue gases.

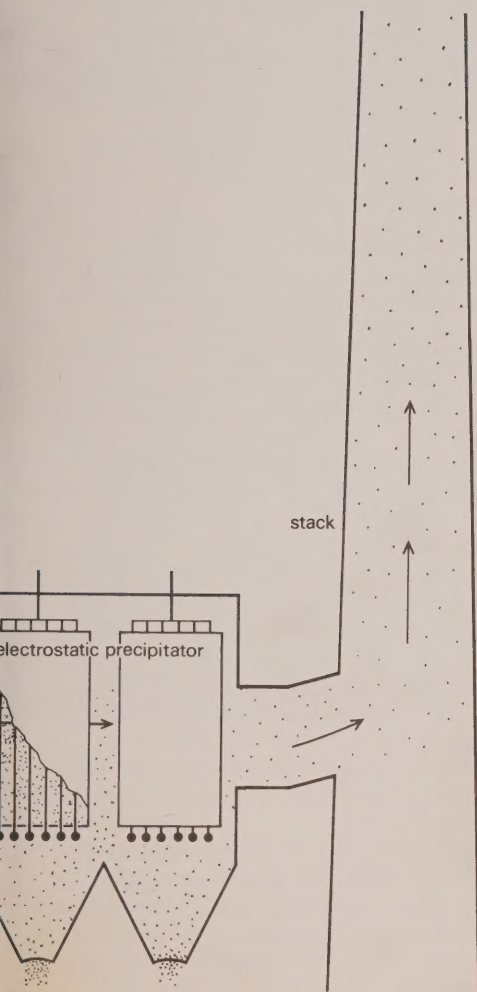
Starting with the Hearn plant on the Toronto waterfront, every fossil-fuelled generating unit has been equipped with precipitators to remove fly ash. Over the years, Hydro's equipment has been upgraded and modern dust collectors are rated at least 99.5 per cent efficient.

## Sulphur dioxide

Efforts to control sulphur dioxide include the erection of tall chimneys which disperse flue gases high into the atmosphere where

*A 700-foot stack was installed at the Richard L. Hearn plant on the Toronto waterfront to replace the original eight chimneys.*





they are rapidly dissipated. The effect is to reduce ground-level concentrations to acceptable levels. For example, a 700-foot chimney was erected in 1971 at a cost of \$9 million to replace the original eight stacks at the Hearn plant. Other plants have stacks ranging from 500 to 650 feet high.

The Hearn plant has also been converted to burn natural gas, which has practically no sulphur content. The conversion involved capital expenditures of \$6 million and additional fuel costs.

As a result of these changes, and many others throughout the city, a significant improvement in air quality has occurred in Metropolitan Toronto.

Hearn's four 100,000-kilowatt units burn natural gas exclusively. The remaining four 200,000-kilowatt units have been modified to burn either gas or coal, or a combination of both, depending on the availability of gas and on atmospheric conditions.

Other methods to reduce sulphur dioxide must be sought, however, because limited supplies of natural gas are available for generating power. The Hearn plant alone consumes as much gas as all other users in Metro Toronto. Supplies of low-sulphur coal, which Hydro burns during adverse weather conditions at certain stations, are also limited, but Hydro is arranging to obtain additional supplies from western Canada.

*Electrostatic precipitators, designed for at least 99.5 per cent efficiency, remove fly ash from the flue gases before they enter the chimneys. The tiny dust particles cling to electrically-charged plates until they are jarred by rapping devices and fall into hoppers for disposal or recycling in the form of concrete products.*

In addition, operational controls are used at fossil-fuelled stations to meet air quality standards set by the provincial government. When air pollution reaches an unacceptable level, power output is cut back until the weather clears.

In 1969, Hydro initiated a major pollution abatement program for fossil-fuelled stations to seek a long-term solution. The cost exceeds \$1 million a year.

Current research involves evaluation of various techniques for removing sulphur dioxide from flue gases. Another process being studied involves the manufacture of low-sulphur, solvent-refined coal that could be burned as a liquid or solid.

In solvent refining, coal is ground and mixed with a solvent to form a slurry which is placed in a high-temperature, high-pressure "reactor." Hydrogen is injected to remove part of the sulphur and additional sulphur is removed by filtering out ash and minerals.

Solvent-refined coal would be expensive but it would be a relatively clean fuel for generating electricity.

A successful sulphur removal system would improve the viability and attractiveness of coal for the Hydro generating system. Large reserves exist in western Canada as well as Hydro's traditional source, the United States.

### **Nitrogen oxides**

Oxides of nitrogen are formed in all combustion processes. They are produced mainly by cars and trucks, but also by power plants and heating units.

Lennox generating station, Hydro's first oil-fired plant, uses a new technique called low excess air firing to reduce nitrogen

oxides and sulphur trioxide. The reduction is achieved by controlling the amount of oxygen used for combustion.

The technique has limited application to coal-fired units, but in oil-fired plants leads to increased thermal efficiency and decreased maintenance costs as well as a reduction in pollutants.

Other methods of controlling nitrogen oxides are being investigated both at Hydro and elsewhere.

### **Other research**

Hydro has also launched studies on the atmospheric dispersion of plumes from generating stations and on localized effects of the Great Lakes basin meteorology on the dispersion of plumes.

Air quality surveys are conducted for initial environmental assessments at potential sites and two to three years before a new station begins operating. During operation, sulphur dioxide sampling is carried out by networks extending out as far as 20 kilometres from a plant. Such surveys yield about 2 million pieces of information for analysis each year, not only on sulphur dioxide but on wind direction and velocity, oxidants and aerosols.

The data are used as a basis for controlling the operation of existing stations to minimize sulphur dioxide concentrations and in planning air quality control measures at new sites.

Monitoring is a day-to-day operational responsibility, not just an element of research. Monitoring and control are as important to operation of thermal-electric plants as checking steam flow or electrical output.

# Water

*Research workers collect samples of aquatic life to study possible effects of the Pickering nuclear power station on Lake Ontario.*



Much of the controversy over waste heat emitted by thermal-electric stations has spilled into Ontario from the United States where many generating stations have been built or proposed on relatively small lakes and rivers.

Fortunately, Ontario has large, relatively cold lakes for generating station cooling purposes. If the discharged heat were considered spread over a whole lake, the effects of such stations could be compared with the natural heat input from the sun. Over a whole year, for example, the total heat input to one of the Great Lakes by a 2,000-megawatt station is equivalent to the amount absorbed by the lake in a half day of sunshine.

Looking to the future, a study sponsored by the federal government showed that even by the year 2000 the total man-made input to Lake Ontario will be an estimated 6 per cent of the annual natural heat content variation of the lake.

The temperature of warm water released from generating stations ranges between 10 and 35 degrees Celsius, depending on lake temperatures which vary widely throughout the year. The water required by nuclear power stations for cooling purposes is raised about 11 Celsius degrees by passing through the condensers. The temperature rise across the condensers of fossil-fuelled stations ranges between 8 and 15 Celsius degrees because of variations in design, but at the higher levels it is tempered back to 11 Celsius degrees above the normal lake temperature by mixing with cold lake water.

Studies show that the warm water discharge tends initially to spread over the surface of the lake because of the lower density of

the warm water. Heat is rapidly given off either to the atmosphere or by mixing with the cooler lake water as it leaves the station. For instance, the temperature rise caused by thermal discharge from a 2,400-megawatt station cannot be detected beyond three miles from the plant.

The capacity of a river to accept a heated discharge depends on its flow and other factors. The St. Clair River, which has an average flow of 177,000 cubic feet a second, quickly dissipates heat from the Lambton generating station, near Sarnia. Such a station located on a river with only a few thousand cubic feet of flow per second would likely need cooling towers or ponds.

If lake or river temperatures rise to an unacceptable level – a level determined by provincial environmental guidelines – output of a specific thermal-electric station could be reduced to meet these regulatory requirements.

## **Research**

Hydro has embarked on a research program with the aim of working in partnership with nature in designing its stations to disperse excess heat with the minimum influence on the aquatic environment. This heat cannot be used for generating electricity and has limited value for other purposes because of its low temperature.

Much remains to be learned about the effects on large bodies of water. The consensus is that warm water may be either beneficial or detrimental depending on the location. Hydro's approach is to study the unique environment at each site to determine the potential effect of thermal discharges in that vicinity.

Hydro engineers and scientists are con-

ducting extensive studies to cover a period of approximately 10 years from site selection through to the post-operational period. In some programs the Ontario Ministries of the Environment and Natural Resources and the Canada Centre for Inland Waters are participating in the research. Estimated cost to Hydro is several million dollars a year.

The studies are divided into five phases:

- Site selection and acquisition;
- Site development and conceptual design of the station;
- Preliminary and project engineering;
- Pre-operational;
- Post-operational.

(The last two phases involve studies carried out two to three years both before and after startup of a station.)

Site acquisition, site development and conceptual design phases include studies to predict the environmental effects of the station. These studies have previously been reviewed with and agreed to by the appropriate regulatory agencies. Results of these studies are included in the environmental assessment document now submitted to the Ontario minister of energy before approval of each project. At potential sites, data are collected on winds, lake currents, water temperatures, lake biology and ice formation to assist in site selection and subsequently in station design.

The biological studies include careful investigations and measurements of phytoplankton, zooplankton, bottom fauna, aquatic weed growth and biochemical oxygen demand. Experimental fishing and fish tagging are also under way.

*Research indicates Hydro's concern about preserving water quality in Great Lakes.*



Thermal plume studies conducted at operating stations enable predictions to be made for proposed plants. As well, a large laboratory model, equipped with a heater and 150 sensors, has been built to simulate conditions at each planned generating station.

In addition to the extensive use of consultants for research, facilities for studying

aquatic biology have been set up at Hydro's W. P. Dobson research laboratory in Etobicoke to study fish and other forms of aquatic life under simulated lake conditions.

Intensive studies conducted at Pickering station show that no species of fish has been eliminated, nor have any changes been detected that could be considered as contributing to irreversible or widespread influence on the ecosystem, either locally or farther afield.

### **Cooling towers**

Hydro's research to date suggests that once-through cooling systems have a minor influence on the aquatic environment. If necessary, remedial measures can be taken.

If Ontario Hydro had to locate a thermal plant on a small inland stream or lake, which could not be used primarily for cooling purposes, cooling towers or a cooling pond would probably be necessary. A 2,000-megawatt nuclear plant would require a cooling pond five or six square miles in area, or a number of cooling towers about 450 feet high.

Besides their high cost and bulky appearance, concern has been expressed about the possibility of fogging or icing in the vicinity of cooling towers in our climate. A study has been conducted by Hydro to assess possible effects of cooling towers on the environment and on the operation of power plants.

### **Improved efficiency**

Looking to the future, the potential inputs of waste heat on water bodies will undoubtedly be increased as thermal generating stations increase in number and size.

The long-term answer lies partly in developing either new or improved methods of generation which make more efficient use of heat. Atomic Energy of Canada Limited has suggested possible designs for nuclear reactors which will increase their efficiency, thereby reducing the amount of waste heat.

It's significant that the efficiency of coal-fired plants has increased 2½ times over the past 40 years, but greater efficiency will be difficult to achieve. Prospects for more efficient energy conversion include the addition of more heat recovery cycles.

Technology offers prospects for development of more efficient gas turbine cycles, fuel cells and magnetohydrodynamic (MHD) units. MHD is a proposed method of generation which converts a plasma of hot gases directly into electricity and adds on a steam cycle to improve efficiency, but many years of costly development will be necessary to create a practical system.

Hydro is keeping in close touch with the evolving technology.

### **Beneficial uses**

Wider recognition is now being given to possible beneficial uses of waste heat for such purposes as fish hatcheries, greenhouse heating and soil warming, district heating, and warming water along the beach near a generating station. Hydro has been co-operating with provincial environmental officials in carrying out studies to assess the feasibility of such projects in Ontario.

One of the main problems of using condenser cooling water is its low temperature, but other possibilities may exist in a nuclear-electric station. Heavy water moderator or spent fuel bay cooling water

circuits involve relatively small flows, but they could provide higher temperatures for a warm water facility than condenser cooling water.

From a utility's point of view, sufficient lead time is required to modify station design to accommodate a planned warm water facility. For example, early decisions must be made on site layout and turbine design. In addition, co-ordination is needed to integrate the complex technical, social and economic factors involved in such a project and to work closely with the utility, planning groups and regulatory agencies.

# Nuclear safety

*"... environmental protection from the effects of Ontario Hydro's nuclear power plants has received greater attention than that accorded any other comparable technology introduced in Ontario in the last 30 years".*

—Task Force Hydro report on nuclear power.

Nuclear power plants are designed, built and operated to be safe. As a result, their safety record is unequalled by any other industry.

The nuclear reactor which produces heat and generates steam to spin turbine-generators is heavily shielded in a steel-and-concrete box. A secondary barrier is the reactor building itself which contains the reactor, steam generators, auxiliary pumps and piping.

Canadian plants use natural uranium with heavy water as a moderator and heat transport fluid. The fuel consists of uranium dioxide pellets sheathed in zircaloy metal pencils which are grouped in fuel bundles. They are arranged in a geometric pattern, engineered for safety, within the reactor core.

Bundles stay in the reactor for about two years and then are stored under water in the station's spent fuel bay. More than 99.9 per cent of the long-lived radioactive materials, including plutonium, are contained within the metal sheaths of fuel bundles and are thus isolated from the environment.

The nuclear reaction is controlled by adjusting the level of the moderator inside the reactor, by manipulating control rods or by injecting a neutron absorber into the heavy water. If necessary, a reactor can be shut down in seconds by inserting the control rods or by releasing the moderator into a dump tank.

*Vacuum building, top, plays important role in protective system at Bruce nuclear station on Lake Huron.*

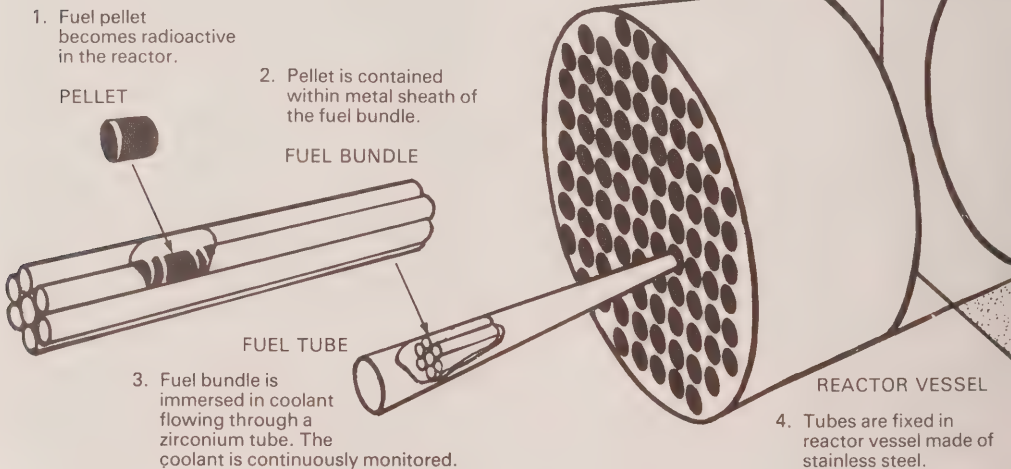


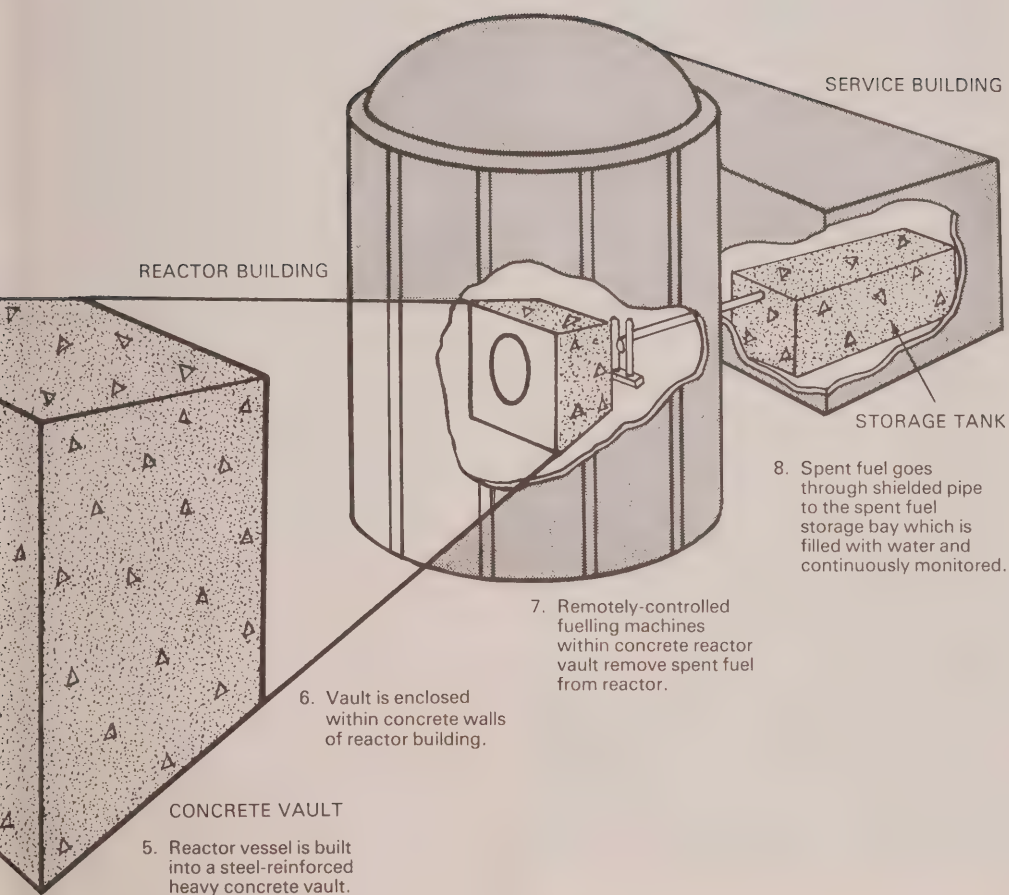
Control systems are triplicated. For example, if the reactor coolant were lost, light or heavy water can be supplied several ways to keep fuel from overheating. Each reactor has two computers to check all regulating mechanisms governing reactor control and operation.

Both Pickering and Bruce stations have concrete vacuum buildings which serve as final protective barriers against the escape of radioactive materials. If a main pipe connection inside the reactor building were ruptured, all the steam would flow through pressure relief ducts into the vacuum building. This structure is designed to contain all the energy that could be released following any conceivable accident.

### Control of emissions

While long-lived radioactive wastes are confined within the plant, small quantities of other solid wastes are buried underground in concrete tile holes or stored in steel-reinforced concrete trenches at special sites. The trenches are capped with reinforced concrete and sealed to keep out water. The site, located at the Bruce Nuclear Power Development, is continuously and carefully monitored.





Minute amounts of short-lived liquid or gaseous wastes are emitted during normal plant operation, but they are strictly controlled and monitored. Standards are such that a person could drink the cooling water emitted from the plant, eat fish caught in it or stand on the station boundary for a year without harmful effects.

In practice, emissions have been indistinguishable from background radiation which occurs naturally in the environment from rocks, buildings and cosmic rays. The additional annual exposure to anyone living near a nuclear plant has been estimated to be about what an airline passenger would receive on a round trip flight between Toronto and Vancouver.

Canada's radiation protection standards, administered by the Atomic Energy Control Board, are based on the work of the International Commission on Radiological Protection. This body was established in 1928 and has members from 14 countries.

These standards reflect the combined knowledge, experience and judgment of some of the world's most outstanding experts in such fields as radiology, radiation biology and health physics.

### **Long-term storage**

To sum up, fuel storage bays keep more than 99.9 per cent of the long-lived radioactive materials contained in fuel bundles isolated from the environment. Hydro will have storage capacity at Pickering and Bruce stations to suffice until the mid-1980s.

Several methods are available for longer-term storage, including continued storage in water-filled bays, dry storage in specially engineered concrete structures or storage

in geological formations like the Canadian Shield. Costs are important, but safety is the overriding consideration.

Ontario Hydro and Atomic Energy of Canada Limited are engaged in intensive studies to determine the optimum methods of storing spent fuel and other solid wastes indefinitely.

When the need arises in the next decade for longer-term storage and ultimately for disposal, detailed plans and procedures will be ready to protect the public, workers, the environment and its resources against hazard. This will be done in a manner which ensures wastes are isolated from the biosphere so that future generations are protected.

# The landscape

*Improved appearance towers are being installed in some locations for high-voltage transmission. Selective cutting of trees provides leafy screen.*

Ontario Hydro is placing increasing emphasis on improving the appearance of transmission lines, power corridors and stations.

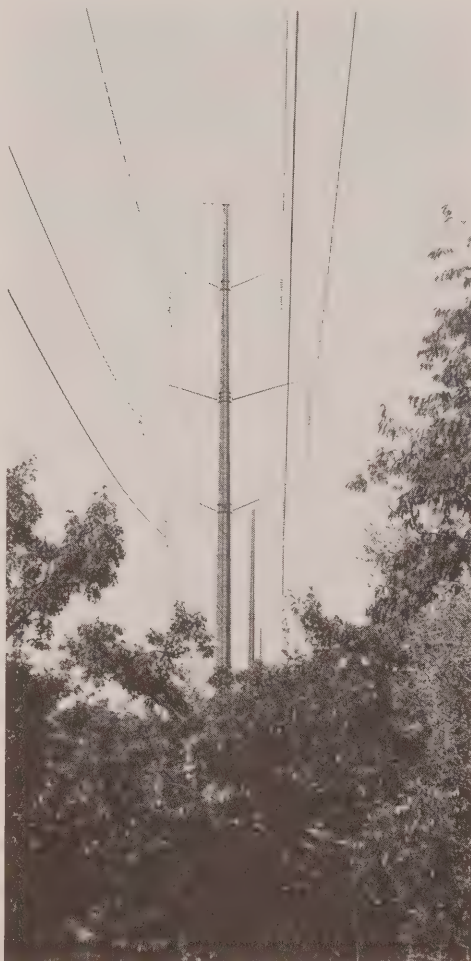
In an effort to intrude as little as possible on the landscape, a major program is under way to improve the design of new transformer and distribution stations and to screen existing facilities with trees and shrubs.

Low-profile transformer and distribution stations are being planned to blend with their surroundings. In some areas, attractive new towers are being installed and other improved tower designs are under active consideration.

## New power routes

Hydro has instituted a new policy for transmission line routes which represents a complete departure from former practices. Elements of the new policy include:

- Public participation in route planning. Details are given in an ensuing section.
  - Selective cutting of trees on rights-of-way and siting of lines to blend with the terrain.
  - Tree planting to camouflage tower lines and to screen road crossings.
  - Use of cover crops and shrubs to prevent soil erosion on rights-of-way and to provide a habitat for birds and small game. Aerial seeding by aircraft is also being practised in remote areas to provide ground cover.
  - Strict controls on herbicide spraying required to check unwanted woody growth which could interfere with power lines.
- Where possible, biological methods, such as the planting of shrubs and ground cover, are substituted.



- A program to open up rights-of-way for multiple uses, including parks, nature trails, turf farms, market gardens, orchards, small tree plantations and nurseries. Land suitable for parks is being made available to municipalities at \$1 a year.

- Qualified landscape architects in Hydro's forestry department are available to advise and assist municipal planners in drawing up plans for parks or other compatible recreation facilities. To blend Hydro facilities with the environs, special landscape techniques would be considered, such as the creation of low, contoured hills. In addition, Hydro will continue to lease back land on the right-of-way for farming.

### **Generating stations**

The new policy applies as well to generating stations. A park and wildlife area are associated with Pickering nuclear power station. Special landscaping and park facilities are planned at major new generating stations proposed or under construction.

*Golf course is one of a number of possible uses of land along transmission line routes.*

*New park, below, enhances surroundings at Pickering nuclear station.*



# Underground transmission

Many miles of underground distribution lines have been built in recent years to serve suburbs and downtown commercial areas in Ontario's cities and towns.

As a result, many people ask why extra-high-voltage lines aren't placed underground as well.

The difference between distribution and transmission is a matter of degree.

Underground distribution at 4,000 volts, or even subtransmission voltages of 44,000, is far different from transmission in the EHV range of half a million.

## Highways of power

An extra-high-voltage transmission line is like a superhighway – it carries large amounts of power over long distances. A distribution line, which is more like a city street, runs over a short distance at relatively low voltages.

High voltages and the large amounts of current to be carried lead to technical problems in underground transmission. A few installations at the 400-kV to 500-kV level have been made in Britain, the U.S. and Japan but these are restricted to short distances – in the neighborhood of half a mile – because of technical limitations and high cost. Each is a prototype of unproven reliability.

The current-carrying capacity of such cable is considerably less than that of an overhead line, so multiple circuits are needed. This makes the cost of an underground 500-kV circuit 20 to 40 times that of an equivalent overhead circuit.

Ontario Hydro has about 115 miles of underground transmission lines in operation or projected at 115,000 and 230,000 volts, mainly in the Metro Toronto area, but again they cover short distances and are extremely costly.

## The problems

Except for a build-up of ice or the occasional wind storm, nature co-operates with overhead transmission. Air serves as an electric insulator and dissipates heat. Such transmission lines operate with a high degree of reliability and a fault can usually be quickly located and repaired.

Underground transmission, however, is a different story. Here are some of the problems:

- **Heating:** Heat is prevented from escaping from an underground conductor by the heavy oil-impregnated paper insulation, by the cable sheath or enclosing pipe and by the earth itself. The problem is compounded by the fact that the hotter a conductor becomes, the higher is its electrical resistance. There are limits to the temperature oil-paper insulation can withstand so that either the electric current must be limited or the cable cooled.

Additional heat is generated by some resistive current flowing through the insulation. This heat increases with the voltage and at 500 kV may amount to more than half the total permissible heat loss.

Cooling methods include packing special backfill around the cables to help dissipate the heat, circulating cool water in pipes beside the cables or placing the cables themselves in oil or water-filled pipes. In London, England, one cable installation is laid in a trough of flowing water.

- **Charging current:** High-voltage cable, insulation and sheath act together as a capacitor which is charged by the alternating current until, at a critical length, no useful current is available unless compensators are installed. Compensators require large above-ground installations at intervals along a line. If one of Ontario Hydro's 500-kV lines were placed underground, compensation equipment would be required every five to 10 miles.

- **Reliability:** A break in an underground high-voltage cable takes weeks to locate and repair compared to a matter of hours with an overhead line failure. For 115-kV and 230-kV cables, the reliability has proven to be acceptable even with longer repair time. For 500-kV cables, the reliability has not been proven and a spare circuit would probably be required in each cable installation. This is another part of the reason for the high cost of 500-kV cable installation.

### **Direct current**

Use of direct current reduces resistance heating and eliminates the problem of charging current associated with normal alternating current. Relatively long lengths of underground DC cable may be installed, but at every terminal or intermediate takeoff point, expensive converter stations (to change DC back to AC) are necessary. These are so prohibitively expensive that direct current installations are best suited to transmitting large blocks of power over long distances without tapoffs. For example, an overhead DC line is used to transmit power from the Nelson River in northern Manitoba to the Winnipeg area. Such installations are not suitable for Ontario's requirements.

### **Research**

Research is under way in many parts of the world on ways of overcoming the technological difficulties in underground high-voltage transmission.

A system using sulphur hexafluoride gas ( $\text{SF}_6$ ) as an insulator is receiving world-wide attention and holds considerable promise. Two short lengths have been installed in New York and Cleveland to avoid cross-overs of existing lines.

Hydro's research embraces conventional types of underground cable,  $\text{SF}_6$  systems and a new concept involving a large duct containing three conductors with air as the insulating medium.

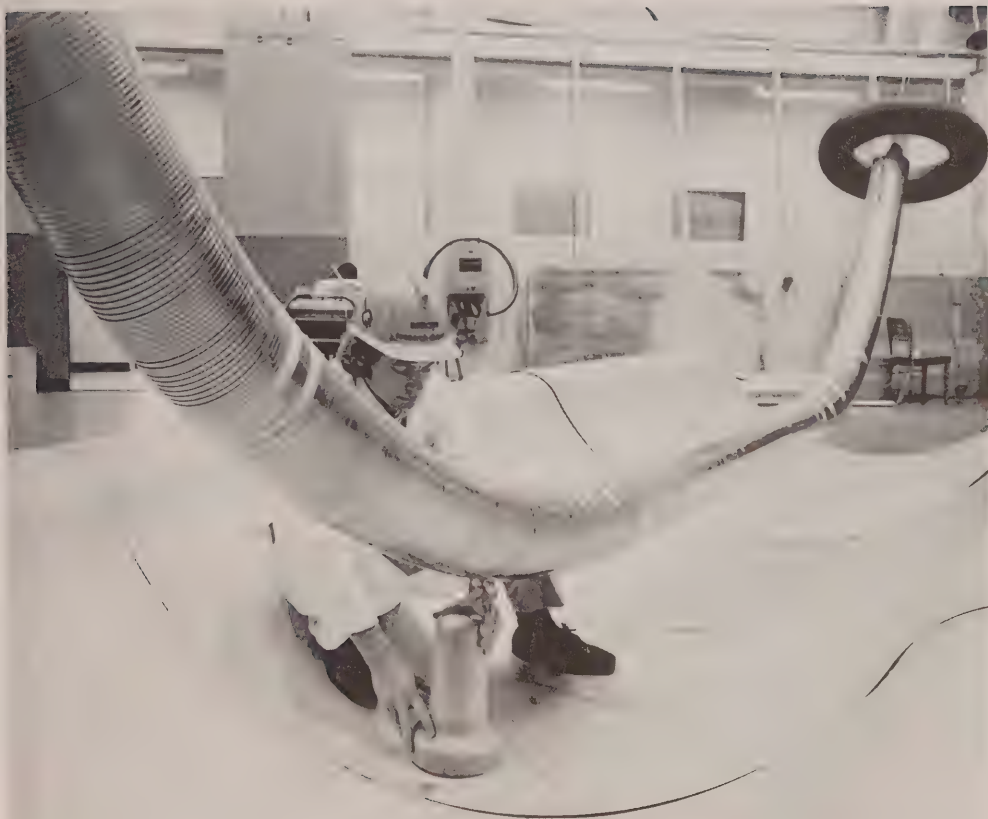
Hydro is testing a short length of gas-insulated cable and has also ordered the first  $\text{SF}_6$ -insulated transformer station for a proposed installation in downtown Toronto.

The new concept is called DAMUT, which stands for ducted air medium underground transmission. A project team has been formed to consider its feasibility. Many problems remain to be solved, however, before a practical underground system is possible.

### **The future**

Underground transmission systems are so expensive they can be introduced only gradually over a period of years in relatively few locations. These are expected to include high-density areas, exits from large generating stations, crossing under existing transmission lines and dips under major highways and scenic areas.

*High-voltage current tests are carried out at Hydro research laboratory on new method of transmitting large amounts of power underground.*



Much progress will have to be made before long-distance underground transmission becomes feasible from a cost and technical point of view.

Supercooled cables with large current-carrying capacity, now in the concept stage, will require many years of development before they are practical for large power systems.

# Public participation

*Hydro representative discusses alternative transmission line routes during public meeting. Information kits, right, are sent to members of the public so they can participate in decisions on power line routes and generating station sites.*

Ontario Hydro is committed to seeking participation by a broad cross-section of the public in planning new transmission line routes and generating stations.

Project teams hold interviews and public meetings in affected areas of the province to hear the views of residents and municipalities on proposed transmission lines. Procedures have also been established to involve the public in the siting of new generating stations.

In addition, Hydro is co-operating with the Royal Commission on Electric Power Planning appointed by the government to hold public hearings throughout Ontario into long-range expansion plans for the provincial power system.

The long-range plan indicates possible requirements for generating stations and transmission lines to supply power demands for various parts of Ontario up to 1993. One of the key issues will be an appropriate growth rate for the future.

## Need for power

Between 1976 and 1980, increasing customer demands for electricity will largely be met by the Nanticoke, Lennox and Bruce generating stations which are now under construction and will produce more than 9,000 megawatts.

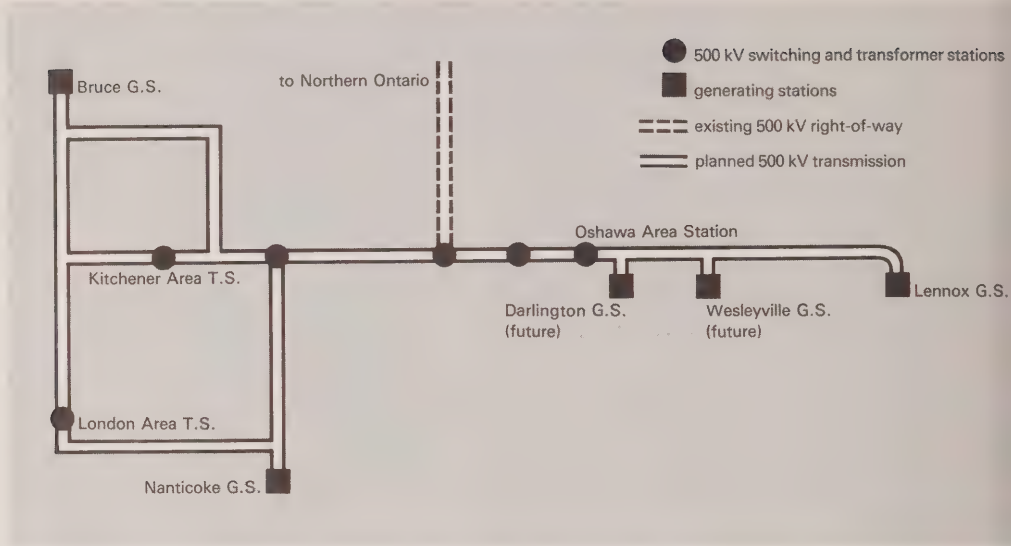
The government has approved plans to double the capacity of the Pickering nuclear power station and to build a new station at Wesleyville, near Port Hope.

As well, a full-scale environmental study involving public participation is planned for a proposed 800-megawatt coal-fired plant at Marmion Lake near Atikokan in northwestern Ontario.





*Rights-of-way for planned 500-kV transmission network.*



Hydro has proposed to double the capacity of Bruce nuclear power station and to build a new station near Bowmanville.

Proposed in-service dates for these projects have been postponed one or two years because of major cutbacks in Hydro's expansion program due to borrowing restrictions ordered by the provincial government.

Output of new stations will feed into the existing 230-kV network and a new 500-kV bulk power transmission system. The 500-kV transmission network, initially proposed for completion in 1978, is shown in the accompanying diagram. It will be integrated with the existing 435-mile, 500-kV line from Northern Ontario hydro-electric plants.

### Study areas

The participatory approach stems in part from recommendations of the Solandt Commission, which was appointed by the government to study the proposed EHV line between Nanticoke and Pickering, and of Task Force Hydro. In his report, Dr. Omond Solandt recommended further studies of alternative routes with increased citizen involvement.

Open planning techniques are also being applied to these proposed transmission line routes:

- Lennox generating station, near Kingston, and the Oshawa area.
- Bruce generating station on Lake Huron, between Port Elgin and Kincardine, and the Georgetown area.

- Nanticoke generating station on Lake Erie and the London-Kitchener areas.

Many similar studies are under way or planned where power facilities are being expanded.

### **The method**

Project teams consist of representatives from such Hydro branches as transmission and distribution, system planning, property, forestry, public relations, stations projects and regional offices.

While public meetings are under way, a comprehensive inventory of the study area is compiled, including information on topography, geology, physiography, soils, surface water, vegetation and wildlife, existing and future land uses, communications systems and other features.

For example, official plans and zoning by-laws of municipalities within the study area are reviewed to determine land use policies. Existing or proposed roads, railways and pipelines are recorded for later study to determine whether Hydro's right-of-way can run parallel to them.

Numerous other features such as towns, villages, churches, cemeteries, schools, parks and historic sites are also taken into account. Municipal officials, interested groups and individuals are interviewed to help determine the importance of environmental factors.

Throughout the entire process, citizens are kept informed of the study's progress through public meetings, local media, and mailed reports. Finally, in conjunction with all interested parties, the most acceptable corridor is identified to produce the specific route of the transmission line.

Because of large construction forces on the job, the location of new power stations has a more direct economic impact on surrounding communities and a different set of factors has to be studied. However, the basic principles are the same. Both new plant sites and line routes, of course, are subject to formal approval by government authorities and agencies.

### **Delay serious**

While committed to the participatory planning approach, Hydro believes the success of the process lies in obtaining a representative cross-section of opinion rather than merely the views of outspoken minority groups.

Undue delays in construction, however, would seriously impair Hydro's ability to meet power demands several years from now.

# Toward a new energy ethic

A new energy ethic is emerging in Ontario which affects Hydro, the associated municipal electric utilities and their 2.2 million customers.

Traditionally, Hydro has been responsive to customer needs for adequate supplies of electric power at low cost. Although Hydro rates have increased in recent years, they are still among the lowest on the continent. But customer needs are changing with the times. It's apparent that people are seeking a clean environment as well as adequate power.

These changing requirements have been underlined by Task Force Hydro recommendations that Hydro should be responsive to government policy as well as customer needs. The provincial government has accepted this view and has made it plain that electric rates must reflect the costs of protecting the environment.

Rising fuel costs are another fact of life in the 1970s. When these are combined with environmental protection costs, they will have a cumulative effect on the rates customers pay for electricity.

Several studies on energy policy carried out for the provincial government have stressed the related themes of environmental protection and energy conservation.

As well, Energy Minister Dennis Timbrell has announced that a major goal is to reduce the rate of growth in per capita energy consumption in Ontario by one-third over the next five years.

The government has launched a number of projects to help all sectors of Ontario's economy to manage their energy use more efficiently. These include energy-saving suggestions to various industries and studies of ways to recycle used lubricating

oils and to reduce fuel consumption in greenhouse and grain-drying operations. Potential savings of about 17 per cent were identified during visits in 1975 to 50 industries which had a total energy bill of \$10 million annually.

As for homes, heat losses could be cut 10 per cent through the use of increased insulation, storm doors and storm windows. The savings on the 60,000 new housing units built annually could be equal to about six billion cubic feet of natural gas or one million barrels of oil in 1980.

"The success of the energy management program will eventually make it possible to reduce the demands for capital for the construction of new energy facilities," said Mr. Timbrell in a statement to the Legislature. "The aim is to reduce the environmental damage resulting from energy use, to extend the life of our non-renewable resources and, in the process, to save money for those who effectively conserve and manage energy."

Hydro has followed suit by urging customers to save energy in homes, farms, commerce and industry.

This booklet indicates Hydro's increasing commitment to its environmental programs. But to preserve the environment, conserve energy and make efficient use of resources will require public co-operation as well.

In an era of diminishing resources, rising fuel costs and concern about the environment, it makes sense to use all forms of energy wisely and efficiently.



